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Title :
Secondary School Students' Understanding of Attributes for Solving Stoichiometry Problems

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The aim of this study was to offer a comprehensive description of 423 secondary school students' level of understanding of the three attributes deemed necessary for solving stoichiometry problems. The three attributes were proportional reasoning, mole concept and chemical equation. This study also investigated the students' ability to solve stoichiometry problems and whether the three attributes have any significant relationship with the ability to solve the stoichiometry problems from the perspectives of academic ability. The students were given an Achievement Test to answer the 19 test items which were divided into three sections of A, B and C and three items for problem solving in Section D. Section A tested the understanding of the proportional reasoning, Section B and C the understanding of the mole concept and the chemical equation respectively. Section D was to determine the ability to solve stoichiometry problems. Cross-sectional descriptive statistics method was employed and the data collected were analysed by frequency counts in terms of percentages. Correlational analysis and stepwise multiple linear regression were employed to determine the relationship between the three attributes with the ability to solve the stoichiometry problems. The findings suggested that students were unable to apply the proportional reasoning learned in mathematics to solving proportional reasoning in chemical equation. The level of understanding to the meaning of the mole concept related to number of particles and mass is on the average. Pertaining to chemical equation, the level of understanding is below average. Students found difficulties in balancing the chemical equation when the ratio of the coefficients of the reactants and products are not 1 : 1 and also poor in explaining the meaning of the coefficients in the chemical equation. The level of ability to solve the stoichiometry problems is also low among the students. However, with better understanding of the three attributes, the ability to solve the problems increases. Generally, the higher achiever students show better performance for all the sections. ANOVA comparisons of means and Tukey HSD test show there is no significant difference between the mean scores for the average and low academic ability students. A need for innovative and creative teaching materials seems essential to enhance the level of understanding of the three attributes and to overcome misconceptions students have of the attributes in order to increase students' ability to solve stoichiometry problems.